REPORT TO THE BOARD OF FISHERIES

GILLNET GEAR EVALUATION STUDY

Prepared by:

M. Alexandersdottir and J. Muir

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1 The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate needs for up-to-date information, reports in this series may contain preliminary data.

INTRODUCTION

This report describes the preliminary findings of a study evaluating the fishing efficiency of four types of gillnet gear construted with different number of filaments in clear and turbid water conditions. In recent years "legal" gillnet gear in Alaska has evolved from "multi-filament nylon", which is comprised of 30 small filaments, to "mono-twist with center core", which is comprised of a center core of 24 very fine filaments around which 6 heavier monofilament strands are wrapped. Regulations promulgated by the Alaska Board of Fisheries for 1988 allow gillnetters to use 6 strand monofilament in Cook Inlet, parts of Prince William Sound, and Southeast Alaska.

In Southeast Alaska, gillnet catch-per-unit-of-effort (CPUE) is a major tool used to manage the four major gillnet fisheries. Inseason CPUE is compared to historical averages to decide weekly gillnet fishing time and areas open. In addition, gillnet coho salmon CPUE is monitored by the Department as an indication of coho salmon abundance in the inside waters, and is used as a data base to manage the outside troll fishery.

As a result of the recent gear changes it is unknown to what extent CPUE patterns during the past few years are reflective of changes in gear efficiency and not run strength. Consequently, in order to standardize inseason to historical CPUE to more accurately manage Southeast Alaska's gillnet fisheries and outside troll fishery, and to provide the Alaska Board of Fisheries with a knowledge of gear efficiencies to assist them in recommending and adopting gear modifications, the Alaska Department of Fish and Game conducted a gillnet gear evaluation study during 1987.

METHODS

The study was conducted in two separate gillnet fishing districts in Southeast Alaska. Gillnet Districts 111 (Taku/Snettisham) and 106 (Sumner Straits) were selected to represent glacial and clear water conditions respectively.

Two test boats were chartered for a full 24 hour period each week for four weeks in District 111 and 106 during the peak of each districts' sockeye and pink salmon returns and for another four weeks during each districts' coho and fall chum salmon return.

Each vessel fished a 200 fathom net comprised of four different 50 fathom panels of gillnet web with hanging ratios of 2.2/1. Gillnet mesh size used during the sockeye and pink salmon fishery was 5 1/4", while that for the coho and fall chum salmon was 6 1/4". Mesh color and thread size matched that which is currently used in each area as suggested by local net distributors.

The panels in each net were comprised of the following types of gillnet mesh.

1. Multifilament nylon with 30 strands (Uroko "2000")
2. Mono-twist with center core (Uroko "Diamond")
3. 6 strand monofilament (Uroko)
4. Single strand monofilament (Uroko)

Within each net, panels were separated by 5 fathom spaces to avoid panels leading fish to adjacent panels. Panels were ordered randomly at the beginning of each 24 hour fishing period, and reordered randomly at approximately half way through the 24 hour fishing period. When setting the net, the end panels were alternated in relationship to the beach as much as possible, in an attempt to reduce any catch bias caused by fish leading the shore.

Species, sex, length, and weight were recorded for each fish caught by panel type for each set. Fishing time was recorded for each set in order to standardize catches to catch per hours fished.

The data was blocked by weeks and fishing period (day vs. night) and designed as a 4 x 2 factorial experiment (factor 1, mesh type, at four levels; factor 2, water clarity, at 2 levels), to compare the effects of mesh type on CPUE. Separate analysis were run in each area (Taku Inlet and Sumner Strait) to compare each pair of mesh types. In order to compare the efficiency of each mesh type the CPUE was standardized to "multifilament nylon", the oldest gear type, under the assumption that the newer gear types should increase in efficiency. For this purpose the CPUE of each mesh type was divided by that of the "multifilament nylon," so a ratio of 1 would indicate no increase in efficiency over the "multifilament nylon" gear. In addition the fish mean length (eye orbit to fork in tail) was compared between panel types and areas.

RESULTS

Sockeye and pink salmon were the major species caught during the summer test fishery and coho and chum salmon during the fall (Figure 1). In general catches differed between weeks and time of day. In Taku Inlet the catch of sockeye and pink salmon peaked in the second week (July 16), and in the first week in Sumner Strait (July 2). In the fall, coho and chum salmon were the most numerous species in the last week of the test fishery (September 17) in Taku Inlet, and coho salmon in the second week (August 26) in Sumner Strait. It was possible to differentiate between day (0400- 2200) and night sets (2200-0400) in the summer, and more salmon were taken during the day in both areas.

The results presented here are for sockeye and pink salmon in the summer test fishery and coho and chum salmon in the fall test fishery. The comparison of mean length between mesh types found no significant differences in the average size of salmon caught by the four mesh types for any species (Table 1). Although there seemed to be a general trend in CPUE with "multifilament nylon" being the least efficient and single strand the most efficient, the results of the statistical analysis comparing the CPUE between mesh types did not show significant differences for all species and areas.

Sockeye Salmon

No significant difference was found in CPUE between mesh types in either area (Table 2). The mean CPUE ranged from 2.9 to 4.1 sockeye salmon per hour fished in Taku Inlet and 1.9 to 2.9 per hour in Sumner Strait. The standardized CPUE (Figure 2) shows little change between mesh types and is evenly distributed around 1.0.

Pink Salmon

The CPUE for pink salmon was found to differ significantly between mesh types in both areas. It ranged from 8.5 to 16.0 pink salmon per hour fished in Taku Inlet and 3.1 to 8.0 in Sumner Strait (Table 2). The single strand was the most efficient type of mesh for catching pink salmon in both areas, and was significantly different from "multifilament nylon" and mono-twist with center core gear in Taku Inlet and from "multifilament nylon" in Sumner Strait (Table 3). Single strand was estimated to be about twice as efficient as "multifilament nylon" in both areas, and about 50% more efficient than "mono-twist with center core" in Taku Inlet (Figure 2).

Coho Salmon

The results differed for coho salmon between the two areas. In Taku Inlet, which was considered a glacial environment, there was not a significant difference in CPUE between mesh types. However, in the clear water area, Sumner Strait, a significant difference in CPUE was found. In Taku Inlet the CPUE ranged from 1.2 to 1.8 coho salmon per hour fished, while in Sumner Strait it ranged from 0.7 to 2.0 salmon per hour (Table 2). Single strand was significantly more efficient than "mono-twist with center core" and "multifilament nylon" in Sumner Strait, but no other comparison was significant (Table 3). Single strand was estimated to be about twice as efficient as "multifilament nylon", and about 60% more efficient than "mono-twist with center core" (Figure 2).

Chum Salmon

There was a difference in the chum salmon results between Taku Inlet and Sumner Strait, similar to that found in coho salmon. In Taku Inlet, the glacial area, there was no significant difference in CPUE between mesh types. The CPUE ranged from 2.8 to 4.0 chum per hour (Table 2) and the median standardized CPUE ranges from 0.9 to 1.3, with individual observations distributed around 1.0 (Figure 2). In Sumner Strait, however, there was a significant difference between mesh types. The CPUE ranged from 0.4 to 1.2 chum salmon per hour fished (Table 2). Only the comparison between single strand and "multifilament nylon" was significant (Table 3), with single strand catching 2.5 times as many chum salmon as "multifilament nylon" (Figure 2).

DISCUSSION

The study shows that there are differences between gear types depending upon a variety of factors. Although gear efficiencies increase as the number of strands in the mesh decrease, the difference is not always significant. Water clarity, time of day, salmon species, and mesh size all are variables which effect the efficiency of each mesh type fished.

Coho and chum salmon are more efficiently caught in gillnet mesh that approaches monofilament characteristics in clear water fishing conditions. Gear type, however does not significantly effect coho and chum catches in glacial water conditions. Sockeye CPUE is not affected by any of the gear types tested in either the clear or glacial areas. "Multifilament nylon", "mono-twist with center core", 6 strand, and single strand monofilament nets are equally as efficient in catching sockeye salmon. Water conditions do not appear to affect the efficiencies of the four gear types with regards to pinks. As the mesh type approaches single strand monofilament in character it catches more pinks independent of water clarity. The 5 1/4" mesh used during the summer fishery is typical mesh size used for catching sockeye. It is not an optimum mesh size used to harvest pink salmon. Differences in catch efficiencies between mesh types could vary if smaller mesh sizes were fished.

Brian Bue's study conducted in Bristol Bay in 1984, comparing "multifilament nylon" with "mono-twist with center core" showed "mono-twist with center core" caught significantly more sockeyes in clear water than "multifilament nylon" gear. Our study indicated there was no significant difference between these two gear types for sockeye salmon.

Bue also concluded "mono-twist with center core" nets were more efficient in capturing sockeye salmon over a greater range of lengths than were "multifilament nylon" nets. This study indicates there was no significant difference in the average size of salmon caught by the four mesh types for any species, when comparing mean lengths between mesh types. This experiment, and Bue's experiment in Bristol Bay indicate that generally as gillnet mesh construction changes with regard to number and type of strands, catch rates for each species of salmon may also change, but that it is dependent upon geographical area, or environmental conditions such as water conditions and tides.

Table 1. Mean length of salmon caught in test fishery 1987.

	Mulitfilament	Center-Core	Six-Strand	Single-Strand
Taku Inlet				
Sockeye Salmon				
Male	594	594	598	594
Female	589	586	588	589
Pink Salmon				
Male	485	486	483	480
Female	492	494	491	490
Coho Salmon				
Male	664	669	660	656
Female	646	647	648	646
Chum Salmon				
Male	656	655	655	654
Female	646	647	648	646
Sumner Strait				
Sockeye Salmon				
Male	592	587	589	595
Female	591	585	591	587
Pink Salmon				
Male	521	525	518	517
Female	524	525	522	519
Coho Salmon				
Male	637	630	633	634
Female	639	634	636	636
Chum Salmon				
Male	646	637	647	642
Female	642	630	625	631

ble 2. Test fishery 1987. Number caught, catch per hour (CPUE) and percent by mesh type.

	Multi Filament (Mono)			Center-core (Diamond)			Six-strand Mono			Single-strand Mono		
	No.	CPUE	%CPUE	No.	CPUE	%CPUE	No.	CPUE	%CPUE	No.	CPUE	%CPUE
ockeye Salmon												
Glacial[1]	295	2.99	21.6	346	2.92	21.0	425	4.06	30.1	405	3.52	27.4
Clear	181	1.95	20.0	226	2.92	29.6	221	2.31	25.6	246	2.43	24.7
ink Salmon												
* Glacial	699	8.54	18.4	881	9.50	20.0	952	12.43	26.7	1403	16.02	34.9
* Clear	235	3.08	15.6	407	5.77	23.3	338	4.01	23.3	696	7.97	37.8
oho Salmon												
Glacial	99	1.24	23.0	105	1.21	19.2	116	1.31	25.2	145	1.85	32.5
* Clear	70	0.74	13.9	111	1.24	22.9	123	1.39	27.3	174	2.01	35.9
Chum Salmon												
Glacial	244	2.84	21.9	216	2.70	19.6	302	3.68	28.1	331	3.96	30.3
* Clear	38	0.39	12.3	73	0.83	28.4	75	0.83	22.8	107	1.17	36.4

[1] Taku Inlet = Glacial
Sumner Strait = Clear

* Significant difference in CPUE between panels.

Table 3. Significance of paired comparisons of mesh types.

		Pink Salmon	Sockeye Salmon	Coho Salmon	Chum Salmon
Taku Inlet					
p[1]		0.0002	0.897	0.31	0.31
Multifilament	- Center Core	NS[2]	NS	NS	NS
	- Six Strand	NS	NS	NS	NS
	- Single Strand	*[3]	NS	NS	NS
Center Core	- Six Strand	NS	NS	NS	NS
	- Single Strand	*	NS	NS	NS
Six Strand	- Single Strand	NS	NS	NS	NS
Sumner Strait					
P		.08	0.34	0.0031	.017
Multifilament	- Center Core	NS	NS	NS	NS
	- Six Strand	NS	NS	NS	NS
	- Single Strand	*	NS	*	*
Center Core	- Six Strand	NS	NS	NS	NS
	- Single Strand	NS	NS	*	NS
Six Strand	- Single Strand	NS	NS	NS	NS

1 Significance level of ANOVA, $p \leq 0.10$ considered significant.

2 Not significant.

3 Comparison significant.

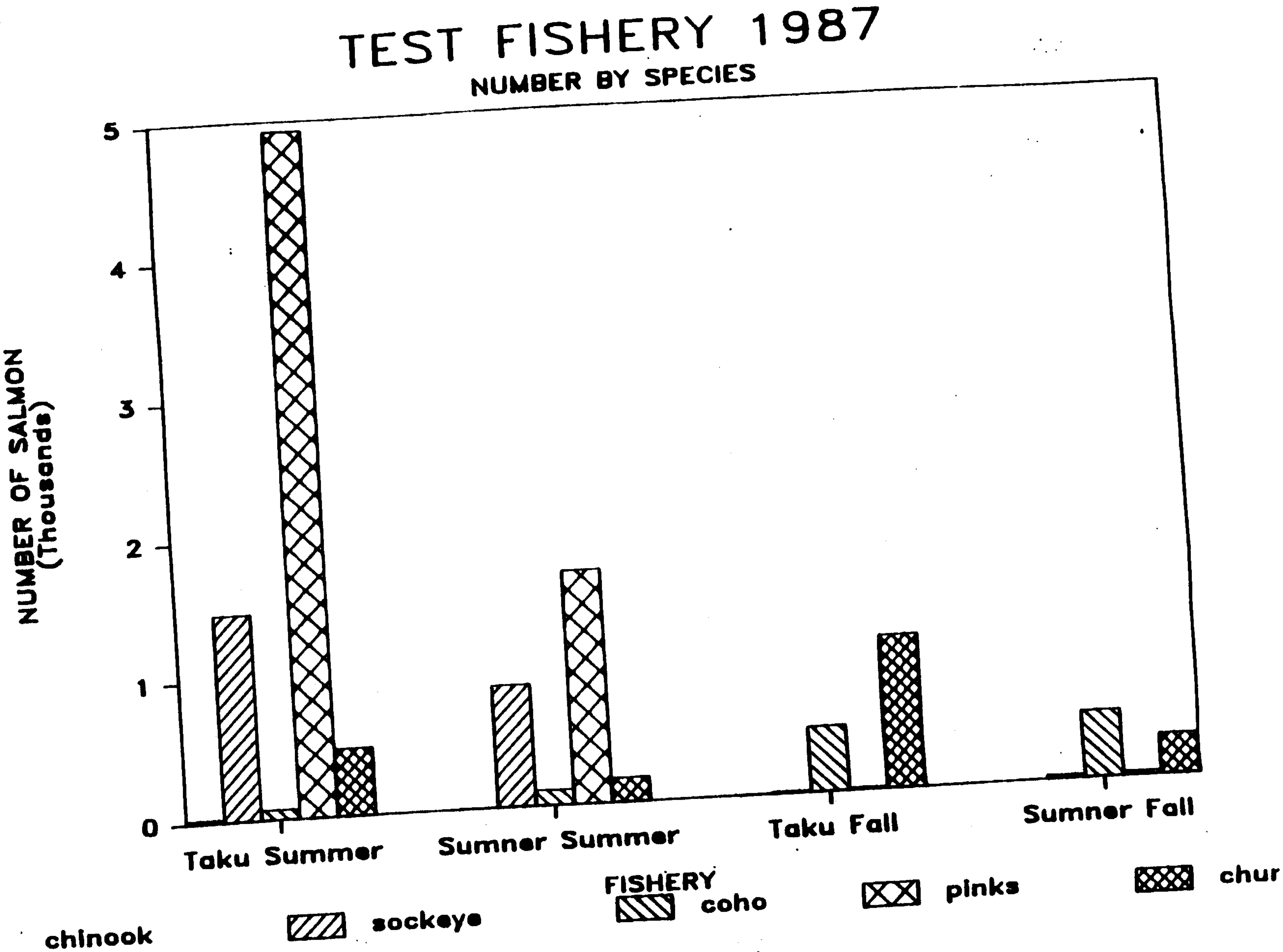

FIGURE ONE. TOTAL SALMON CAUGHT BY SPECIES AND LOCATION IN TEST FISHERY 1987.

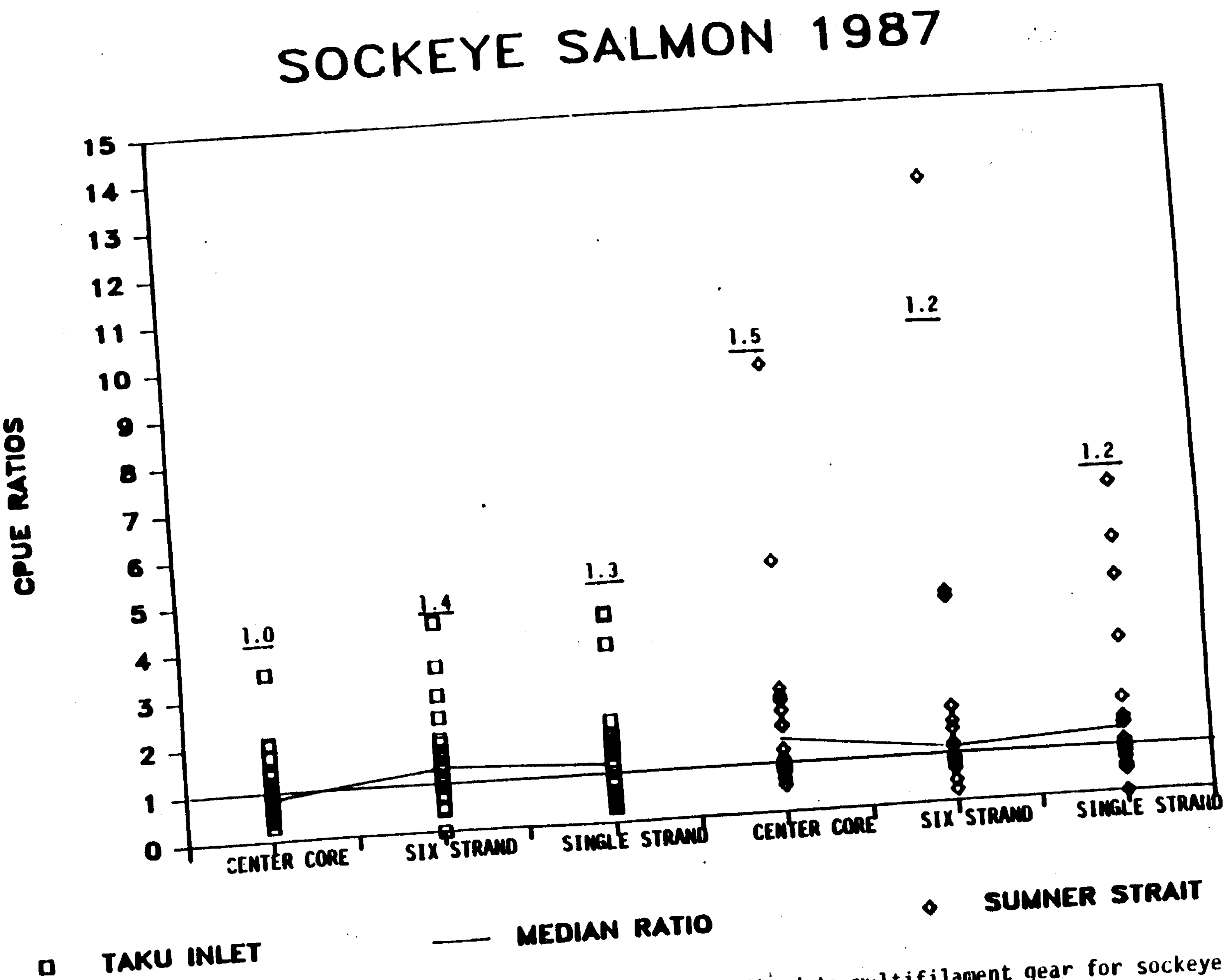

FIGURE 2a. CPUE (Catch per hour fished) standardized to multifilament gear for sockeye salmon in Taku Inlet and Sumner Strait 1987.

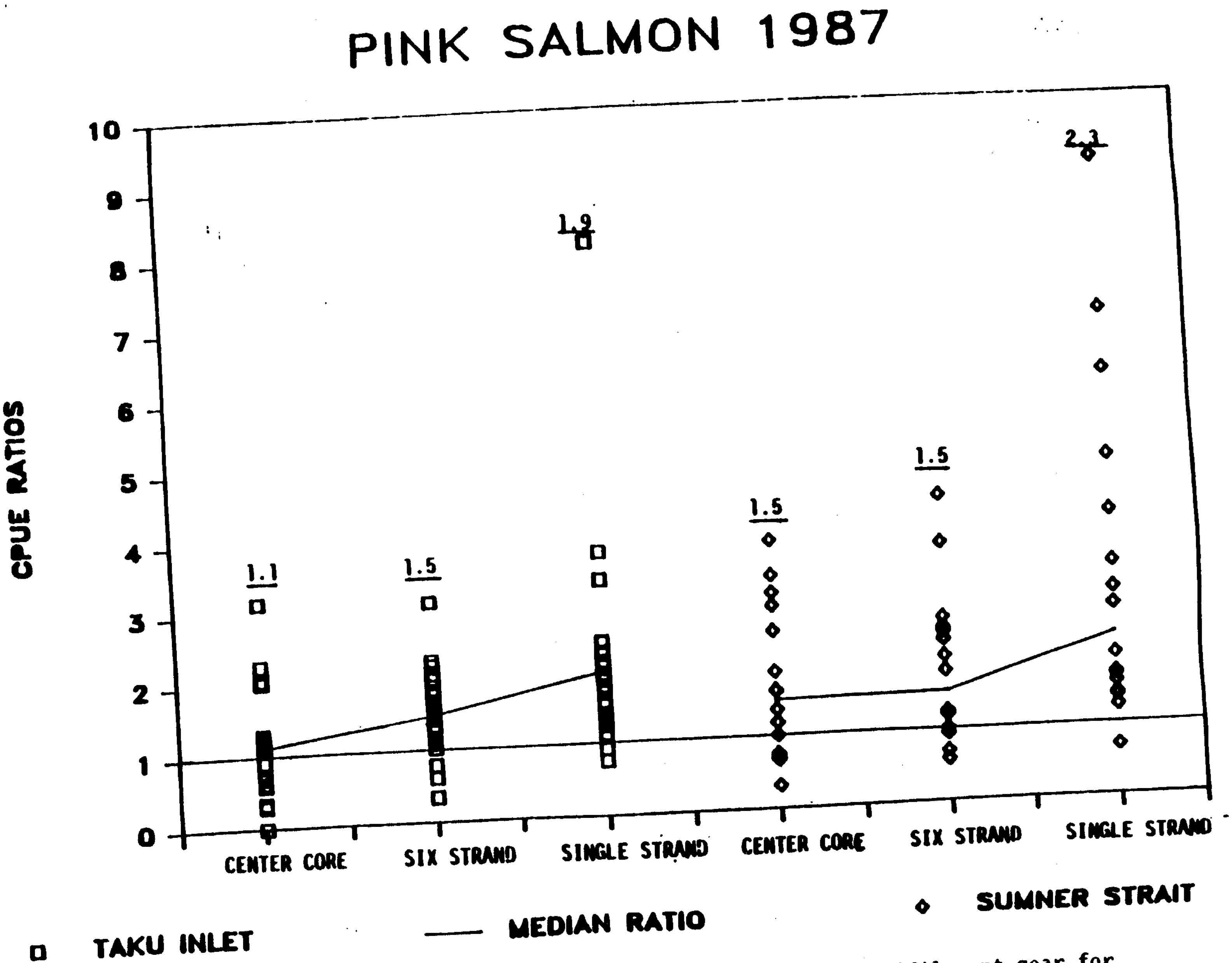

FIGURE 2c. CPUE (Catch per hour fished) standardized to multifilament gear for pink salmon in Taku Inlet and Sumner STrait 1987.

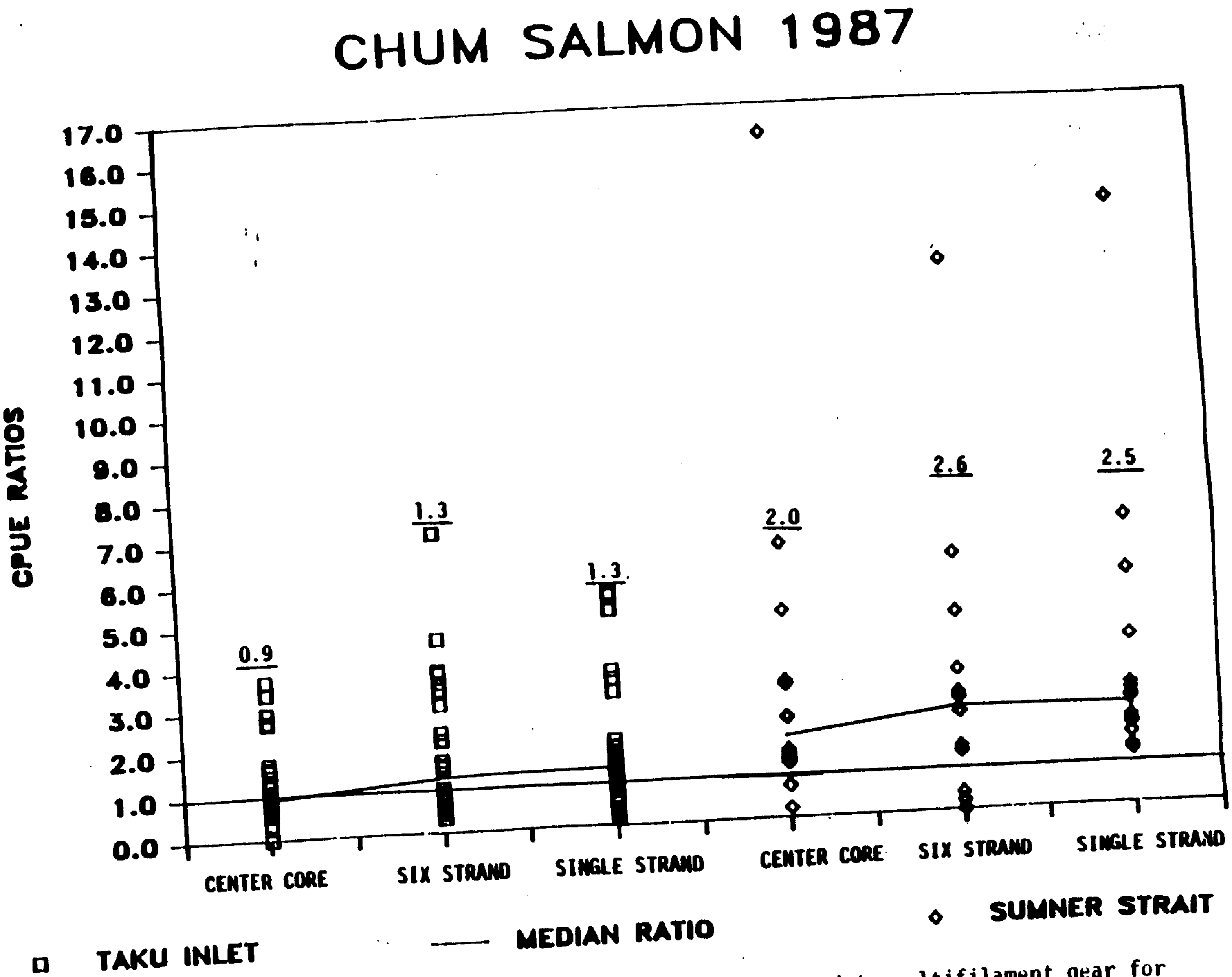

FIGURE 2d. CPUE (Catch per hour fished) standardized to multifilament gear for chum salmon in Taku Inlet and Sumner Strait 1987.

COHO SALMON 1987

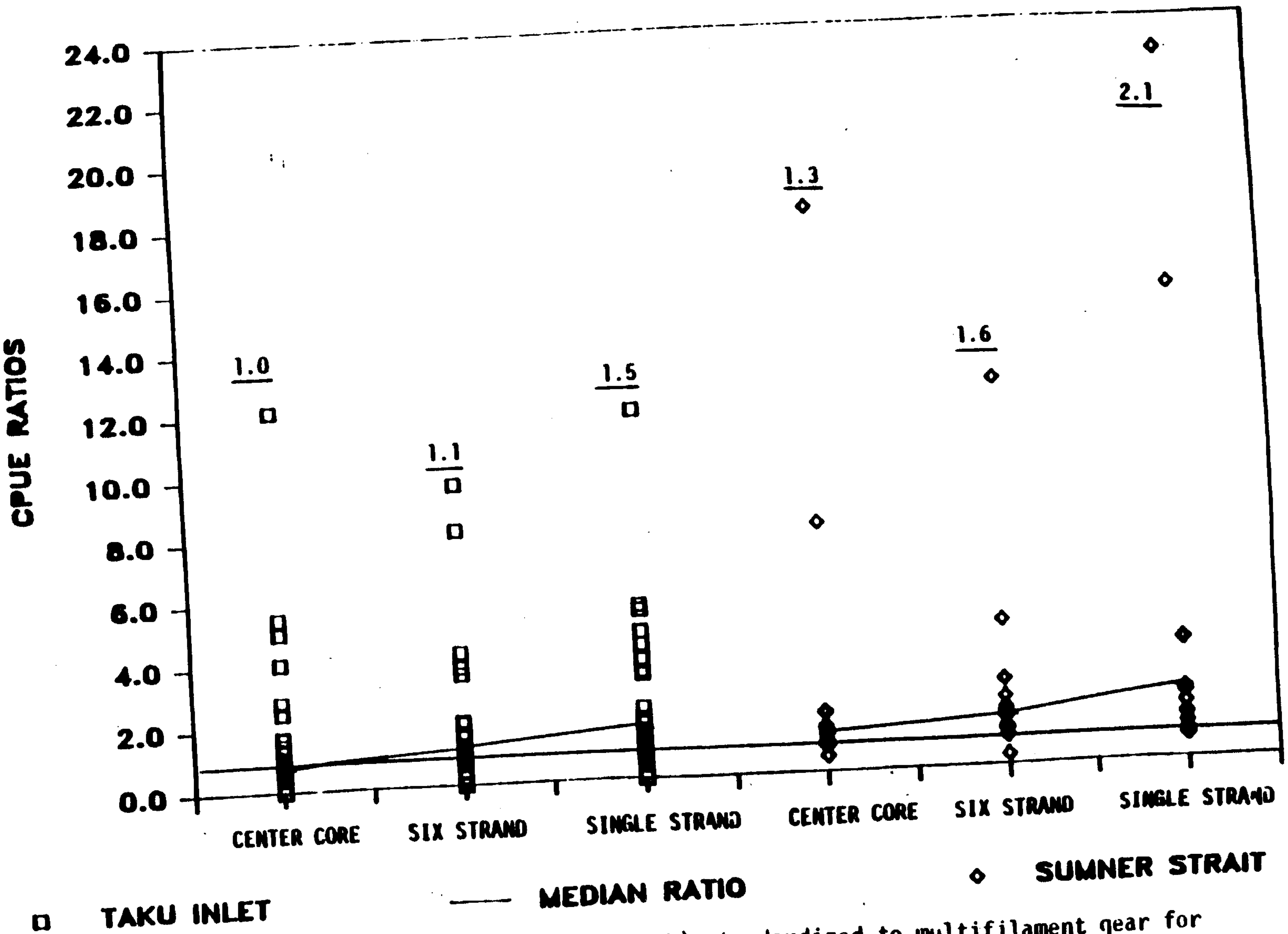

FIGURE 2b. CPUE (Catch per hour fish) standardized to multifilament gear for coho salmon in Taku Inlet and Sumner Strait 1987.